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(54) **AUTOMATIC THERMOSTAT SCHEDULE/PROGRAM SELECTOR SYSTEM**

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See application file for complete search history.

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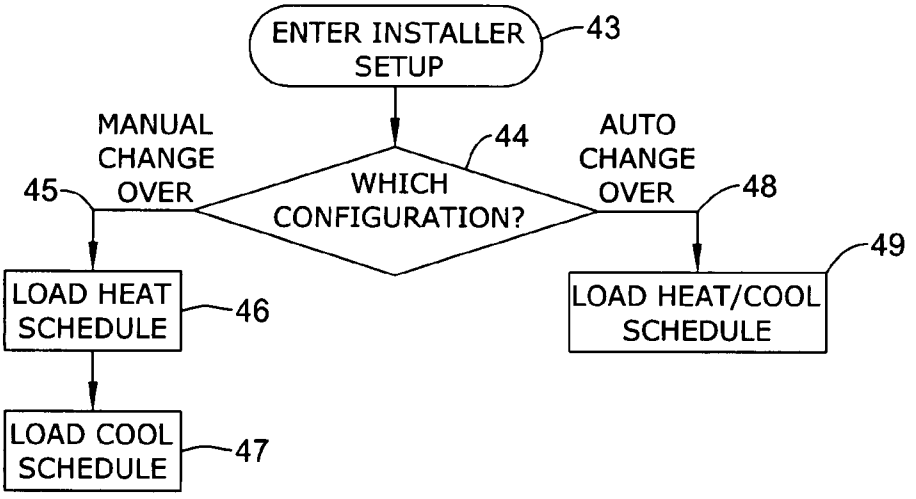
(57) **ABSTRACT**

A thermostat system having multiple and individual schedules. For instance, a user may have different schedules and setpoints for heating and cooling. An appropriate schedule combining individual schedules may be automatically selected based on a system configuration. Schedule control may involve manual changeover from one schedule to another or automatic changeover relative to the schedule combining schedules. The thermostat system may be programmable. Also, there may be a system switch mode, for example, between heat and cool, where the schedules of either may be edited. Scheduling may be menu and option key driven.

11 Claims, 20 Drawing Sheets



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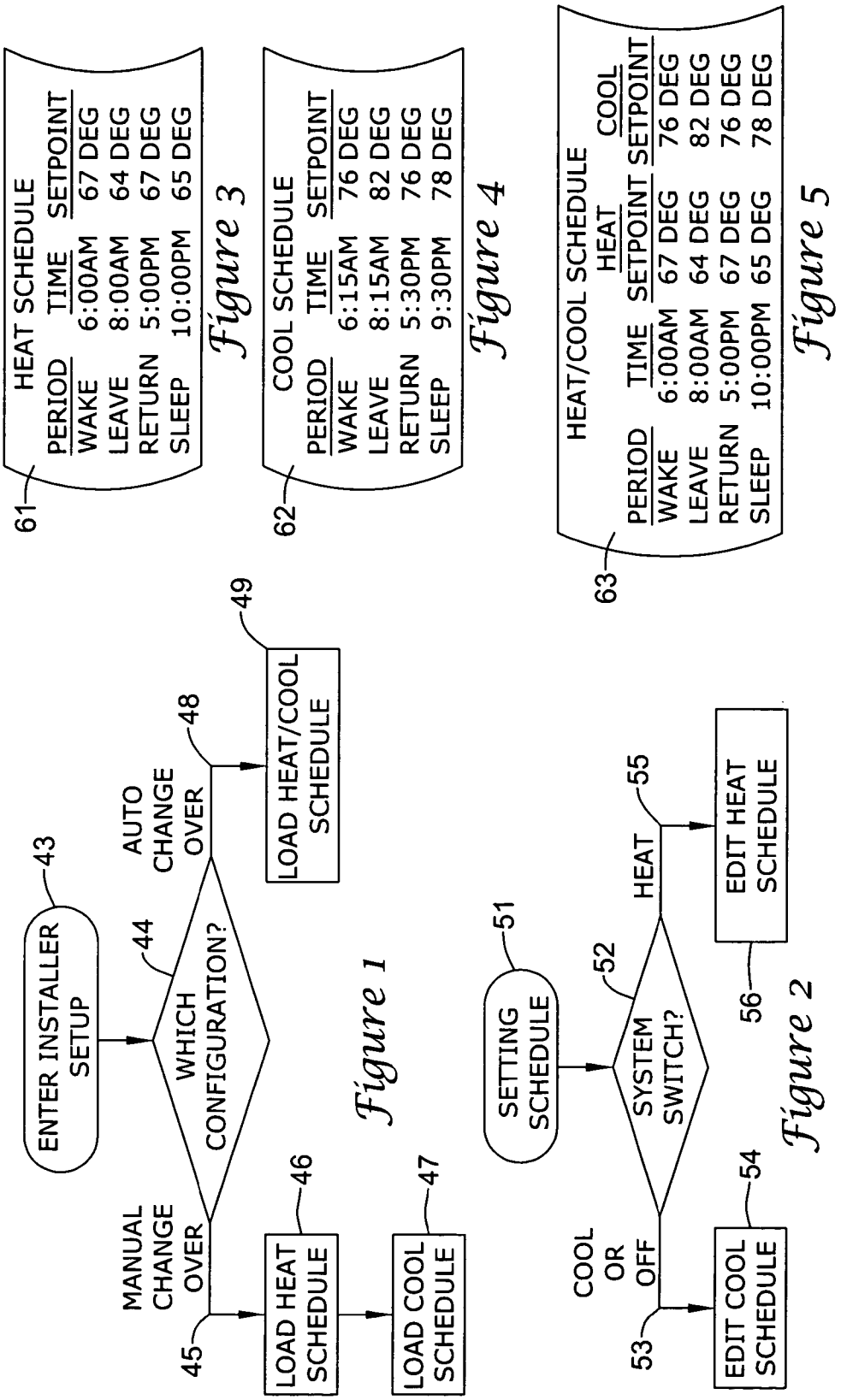

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

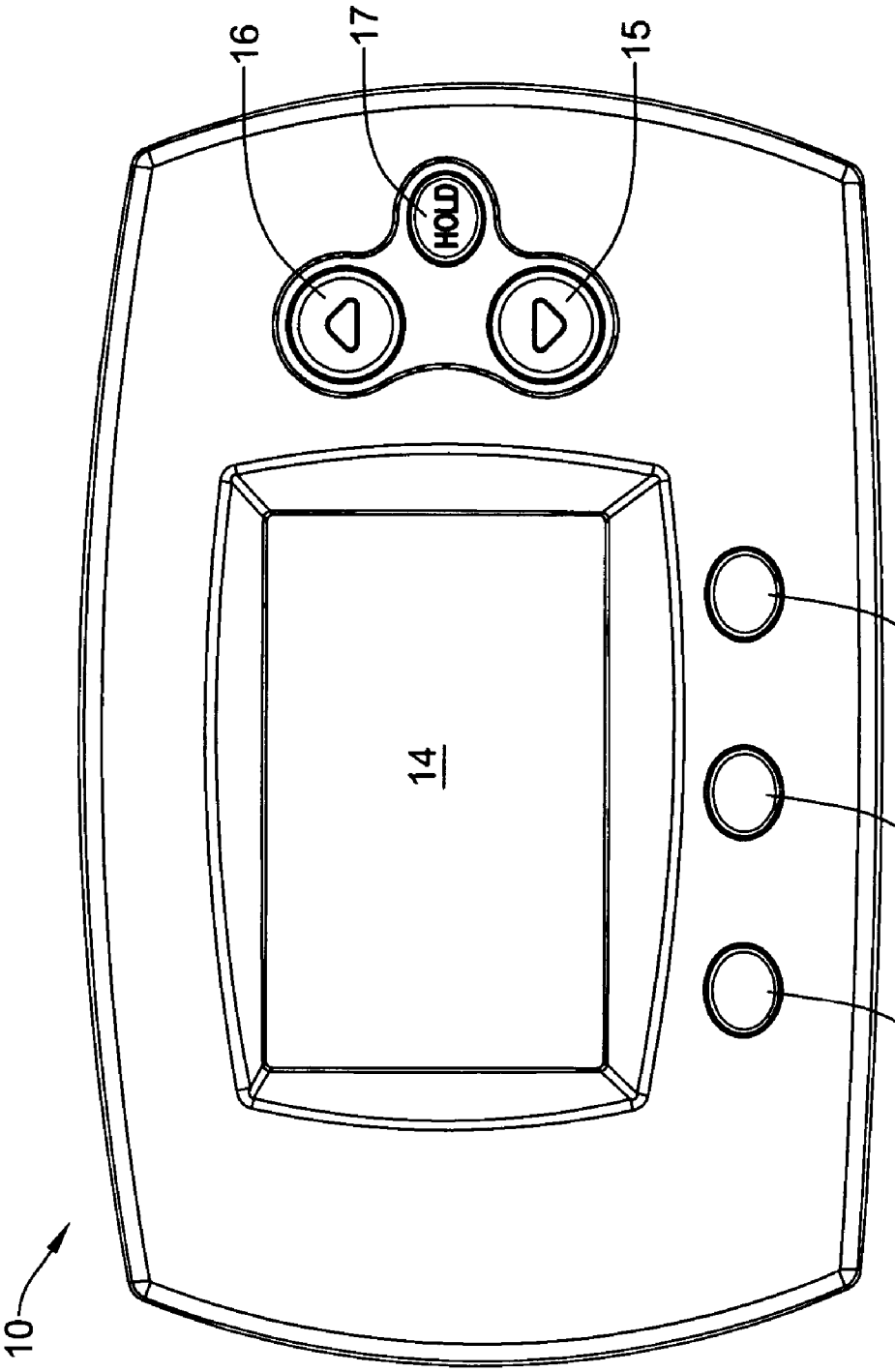

Figure 6

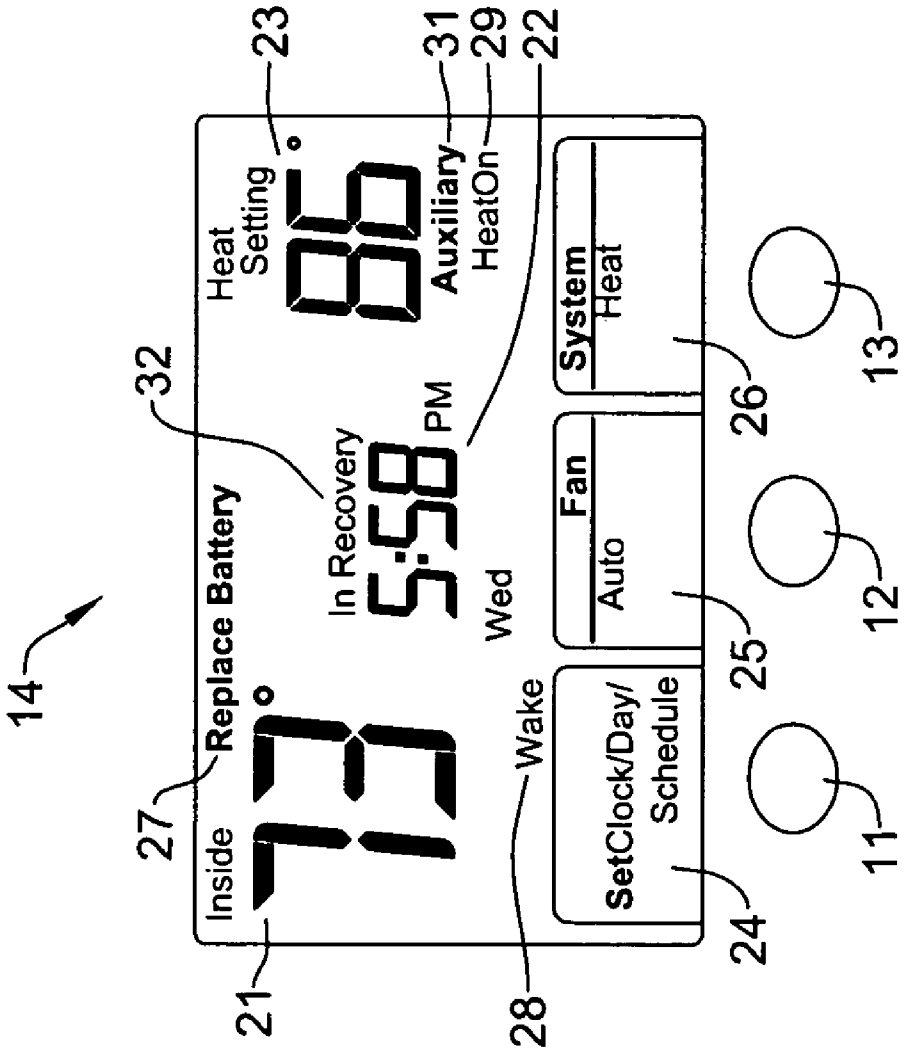
14
Inside
Replace Battery
77°
In Recovery
5:58 PM
Wed
Heat Setting
86°
Auxiliary
HeatOn
Wake
SetClock/Day/ Schedule
Fan
Auto
System
Heat
21
22
23
24
25
26
27
28
29
31
32
11
12
13

Figure 7

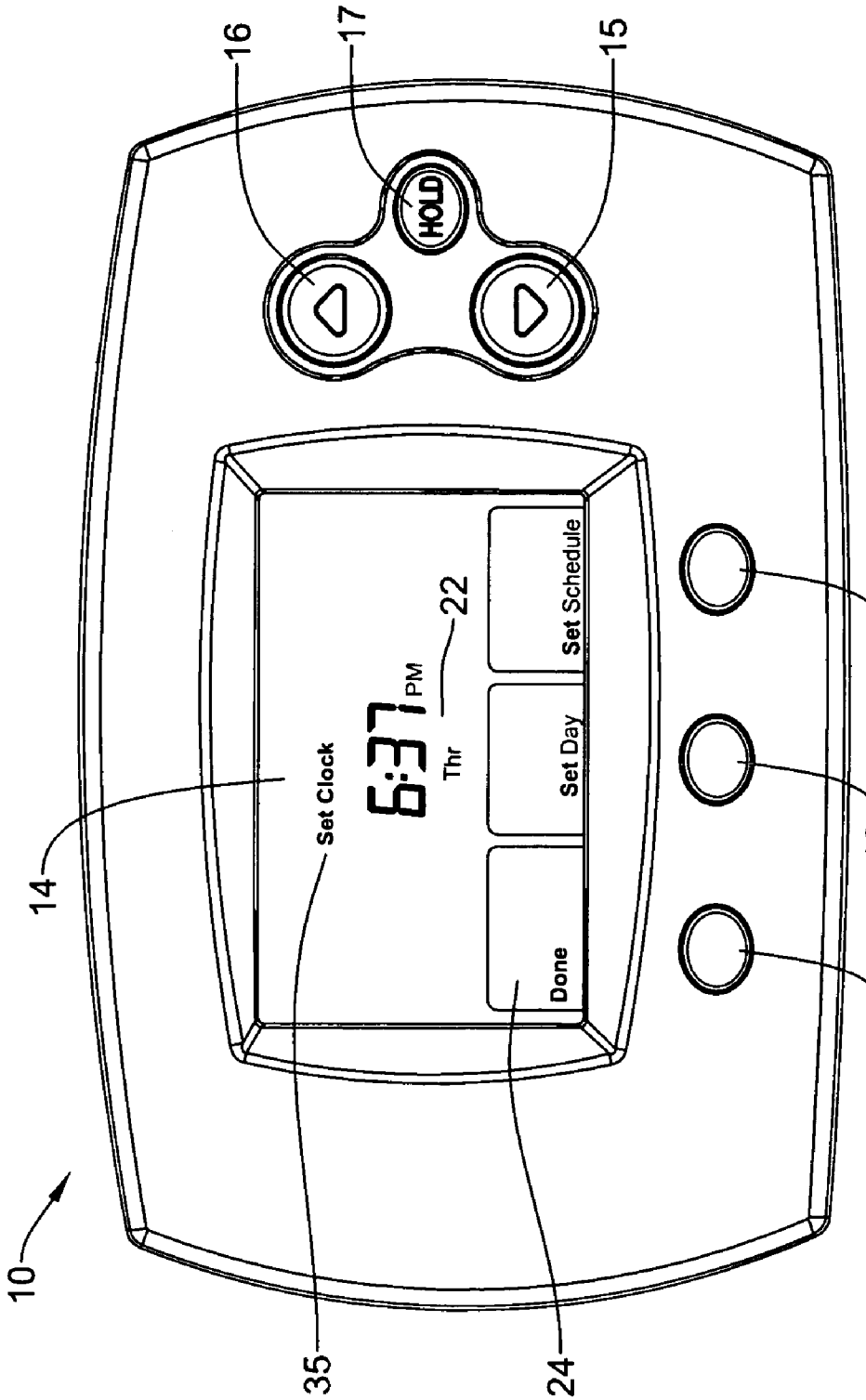
16
17
15
HOLD
Set Schedule
Set Day
Done
Set Clock
6:37
PM
Thr
22
13
12
11
14
10
35
24

Figure 8

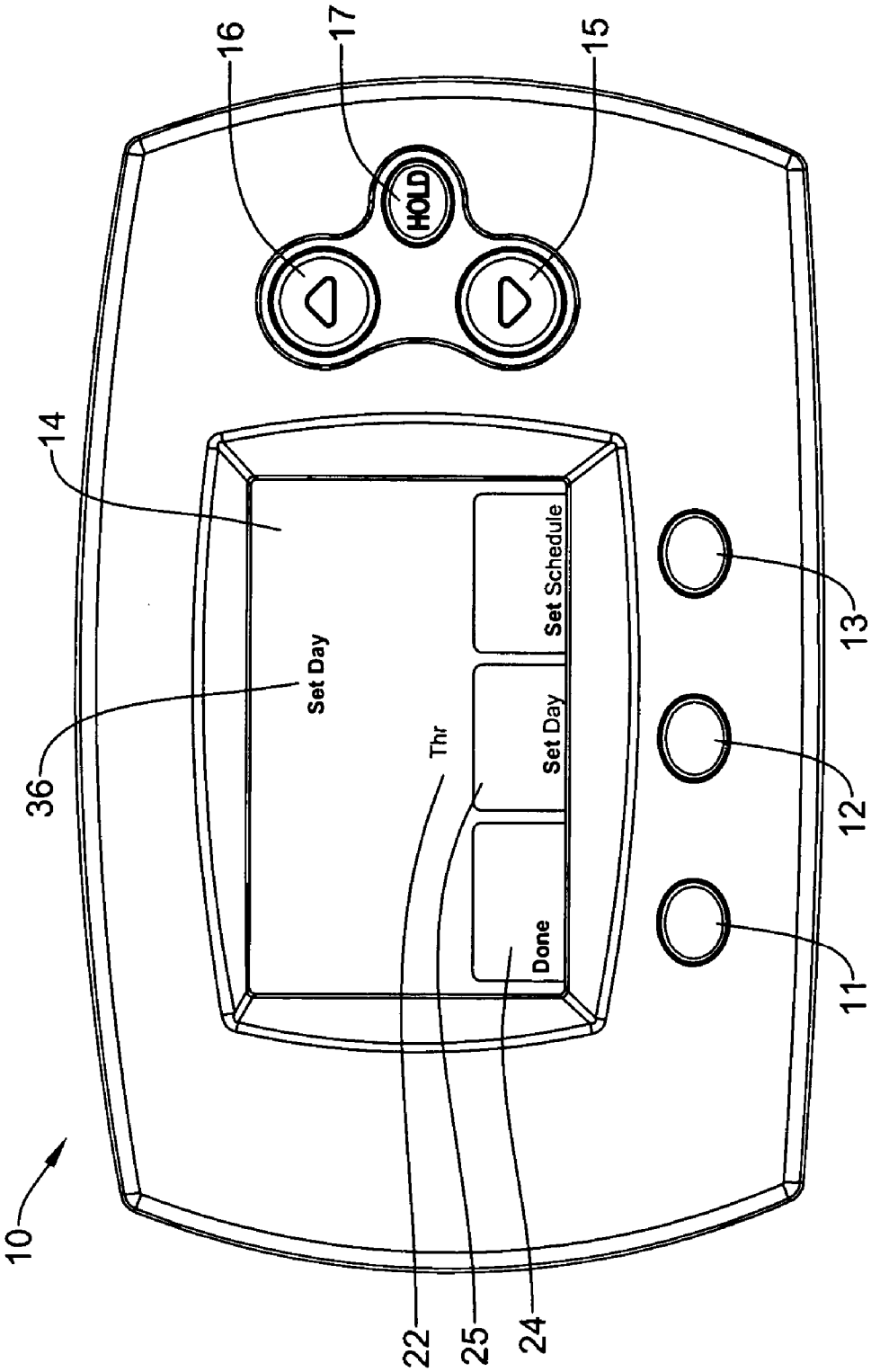
16
17
15
HOLD
14
Set Day
Thr
Set Day
Set Schedule
Done
36
13
12
11
10
22
25
24

Figure 9

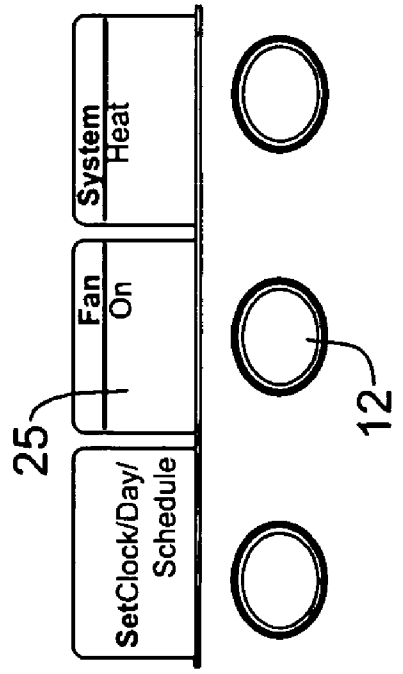

Figure 11

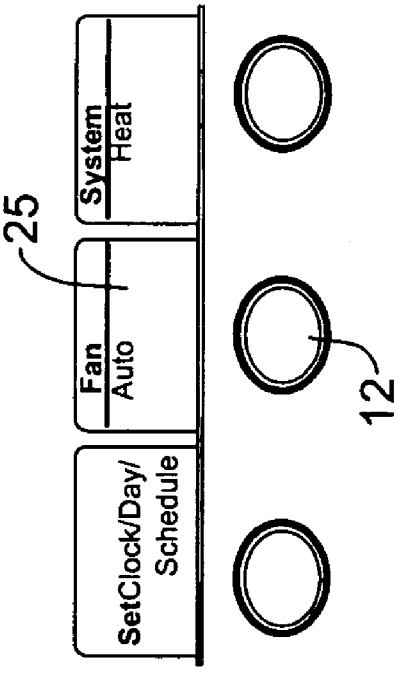

Figure 10

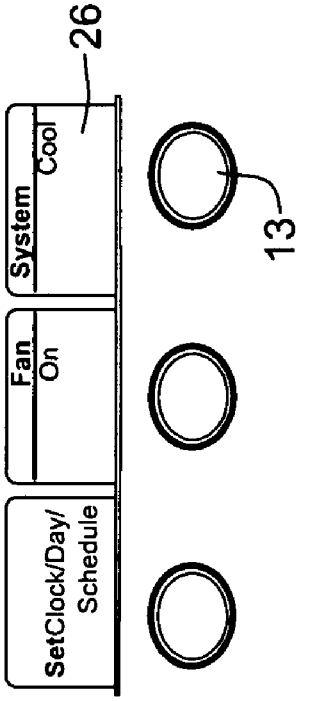

Figure 13

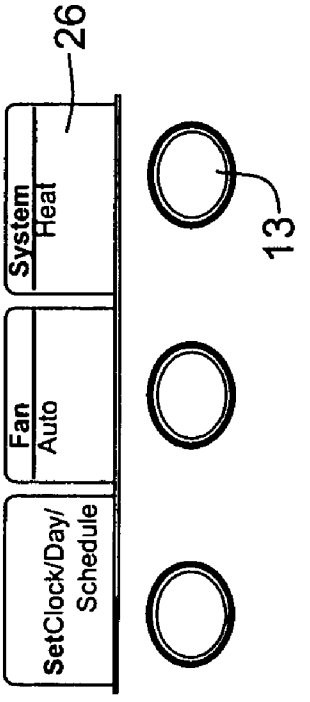

Figure 12

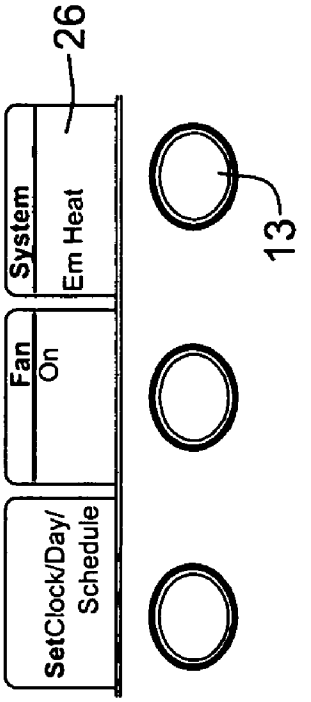

Figure 15

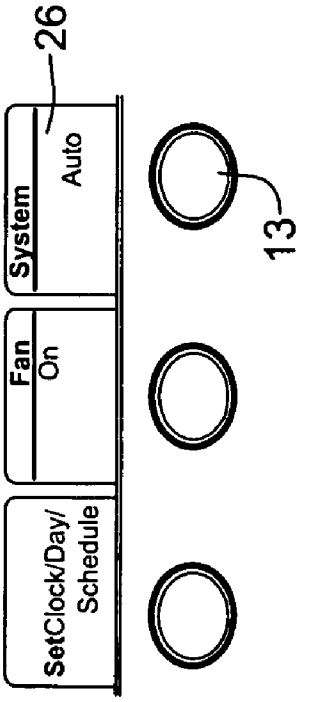

Figure 14

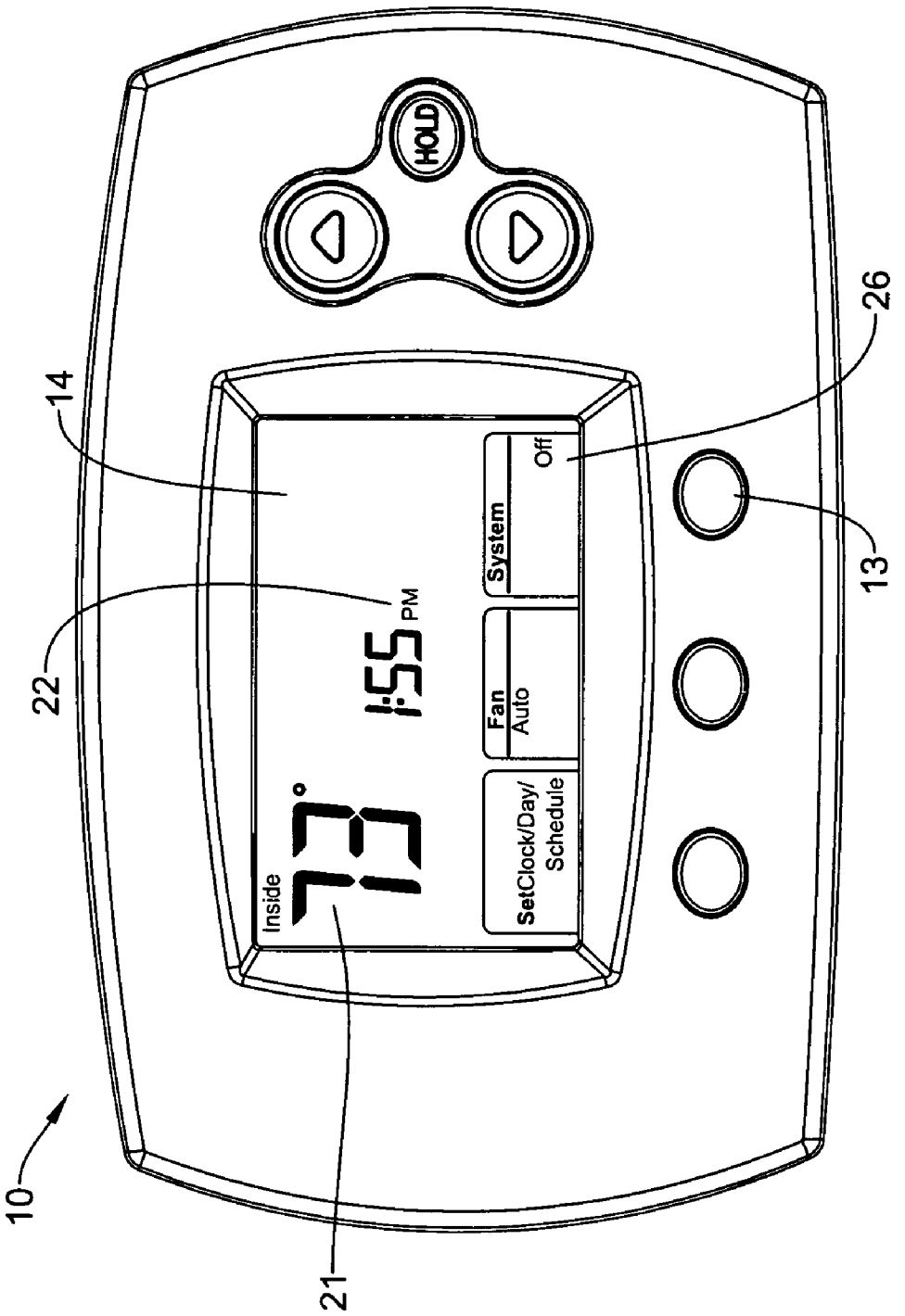
HOLD
System
Off
Fan
Auto
Set Clock/Day/
Schedule
Inside
73°
1:55 PM
10
14
21
22
26
13

Figure 16

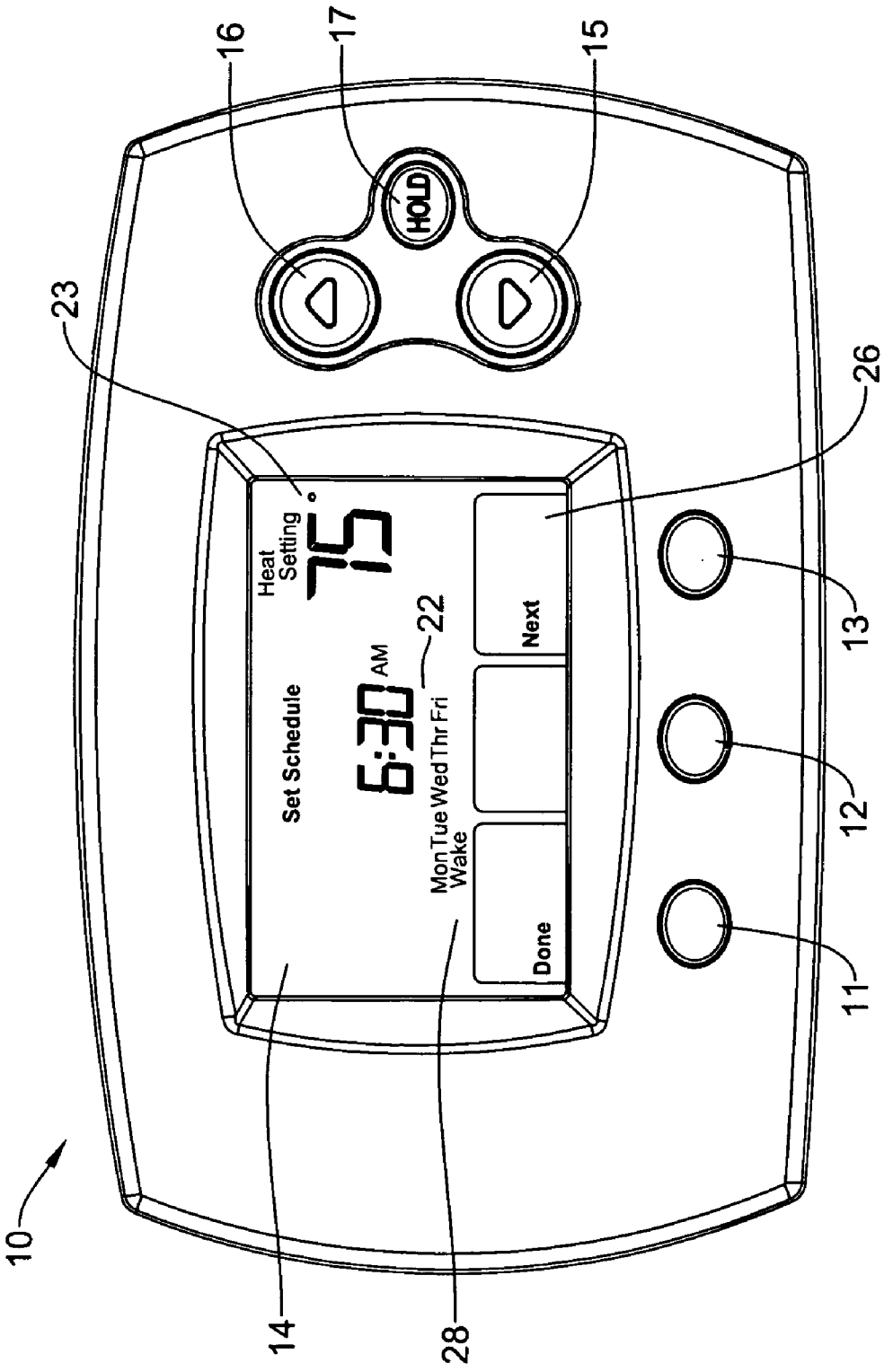
16
17
15
HOLD
23
26
Heat Setting
75°
Set Schedule
6:30 AM
22
Mon Tue Wed Thr Fri
Wake
Next
Done
13
12
11
10
14
28

Figure 17

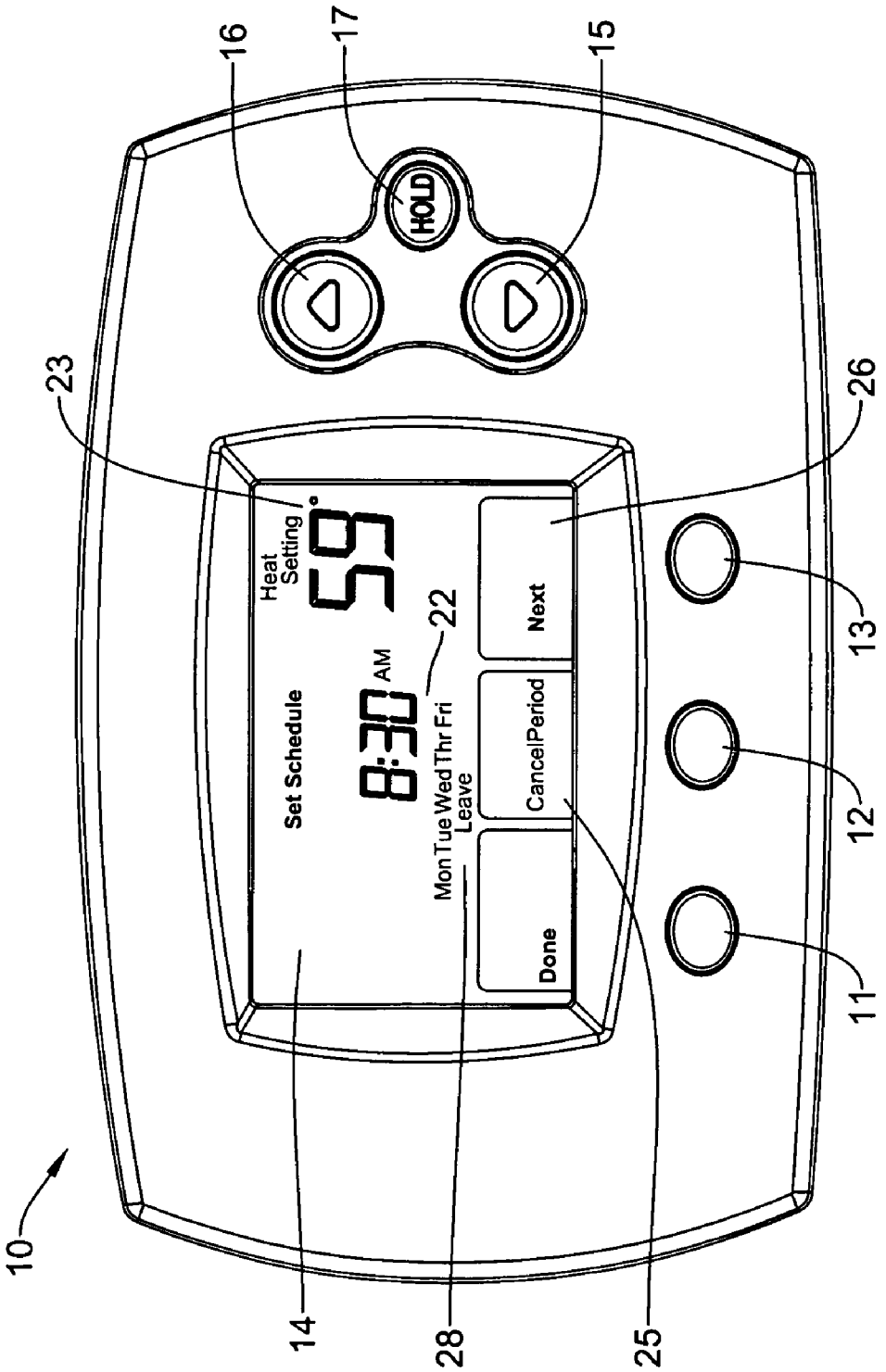
16
17
15
HOLD
23
26
Heat
Setting
59°
Set Schedule
8:30 AM
22
Mon Tue Wed Thr Fri
Leave
Next
Cancel Period
Done
13
12
11
10
14
28
25

Figure 18

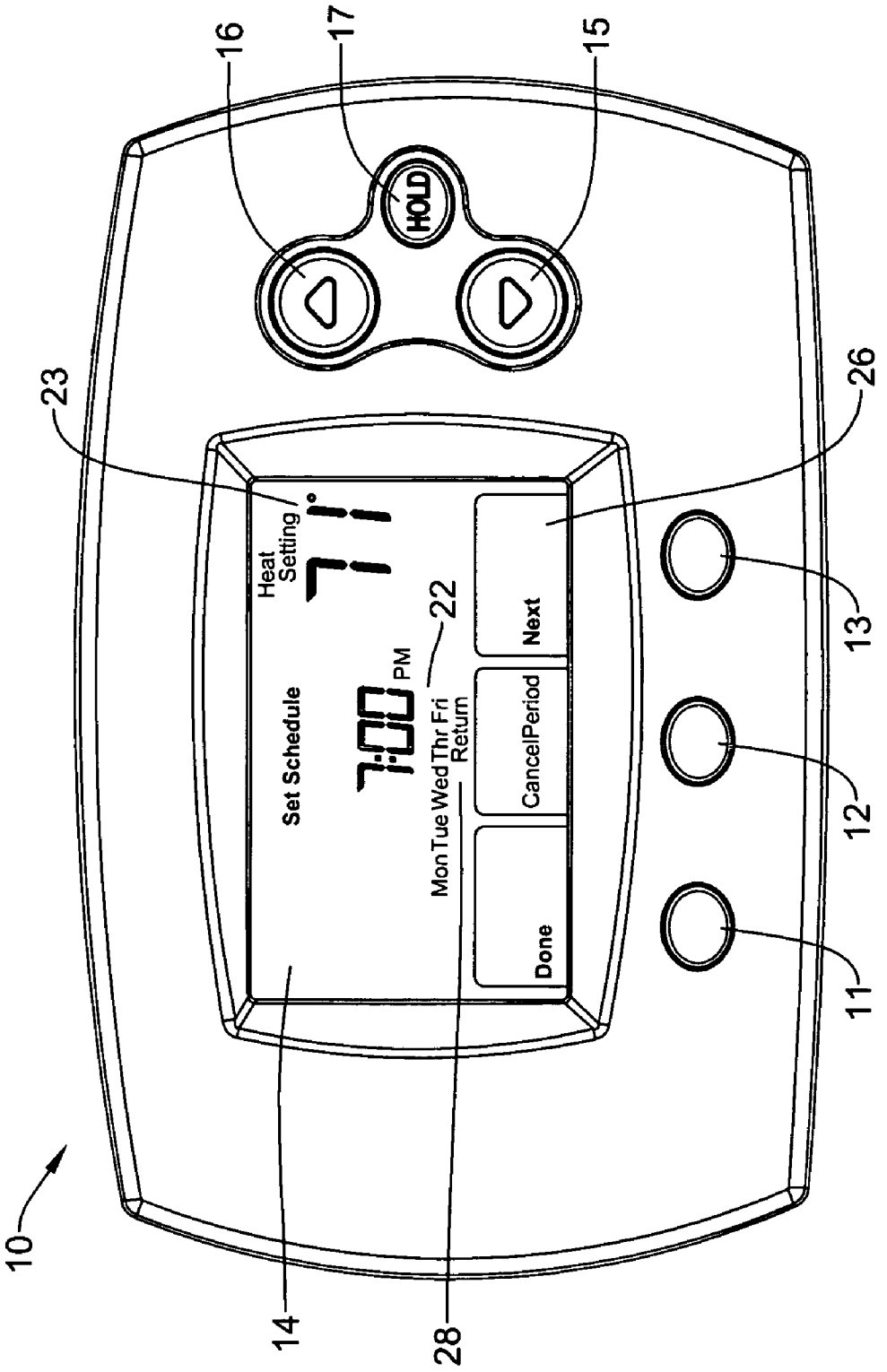
16
17
15
HOLD
23
26
Heat Setting
71°
Set Schedule
7:00 PM
22
Mon Tue Wed Thr Fri
Return
Next
CancelPeriod
Done
13
12
11
10
14
28

Figure 19

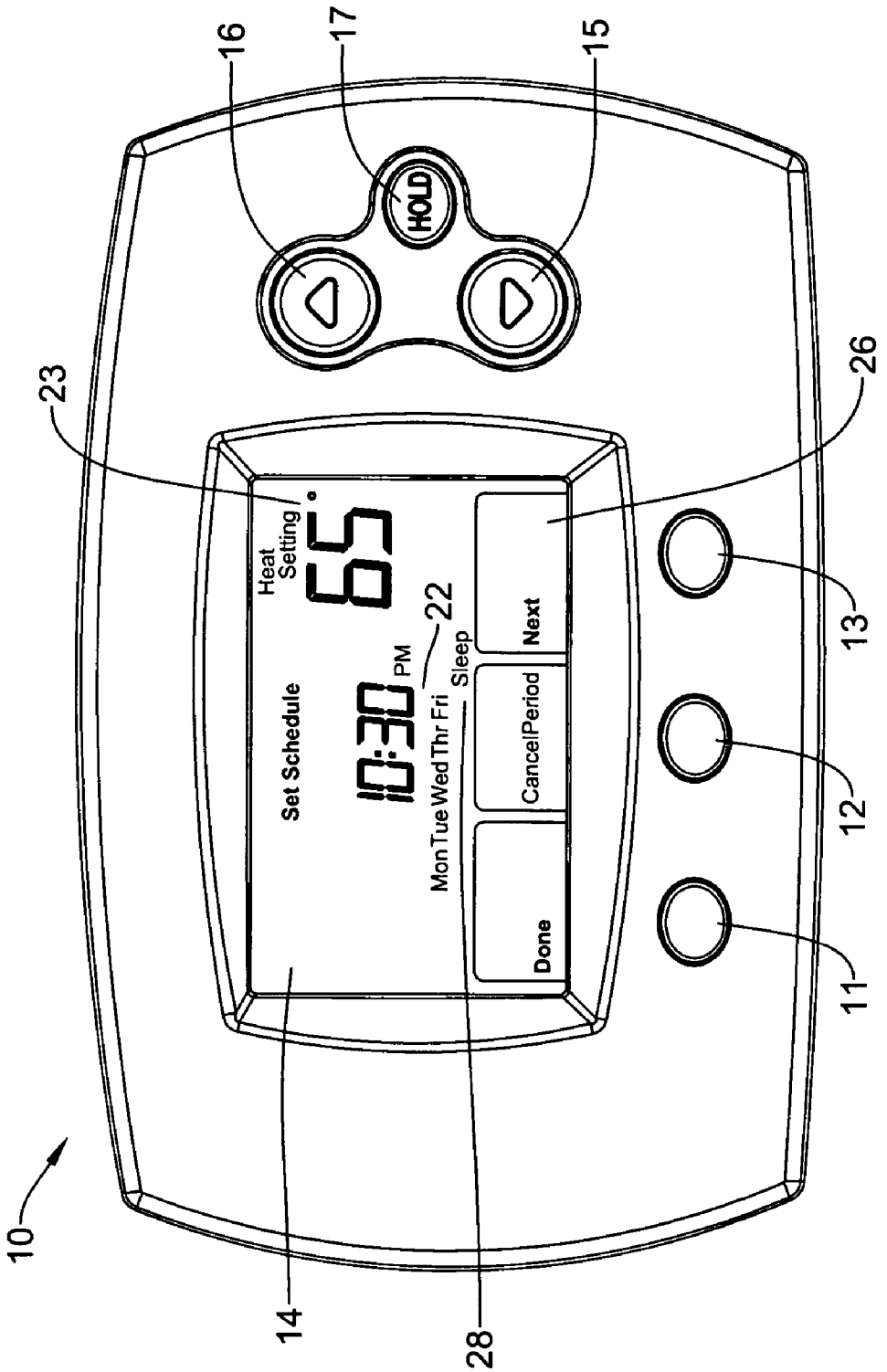
16
17
15
HOLD
23
26
Heat
Setting
65°
Set Schedule
10:30 PM
22
Mon Tue Wed Thr Fri
Sleep
Next
Cancel Period
Done
13
12
11
10
14
28

Figure 20

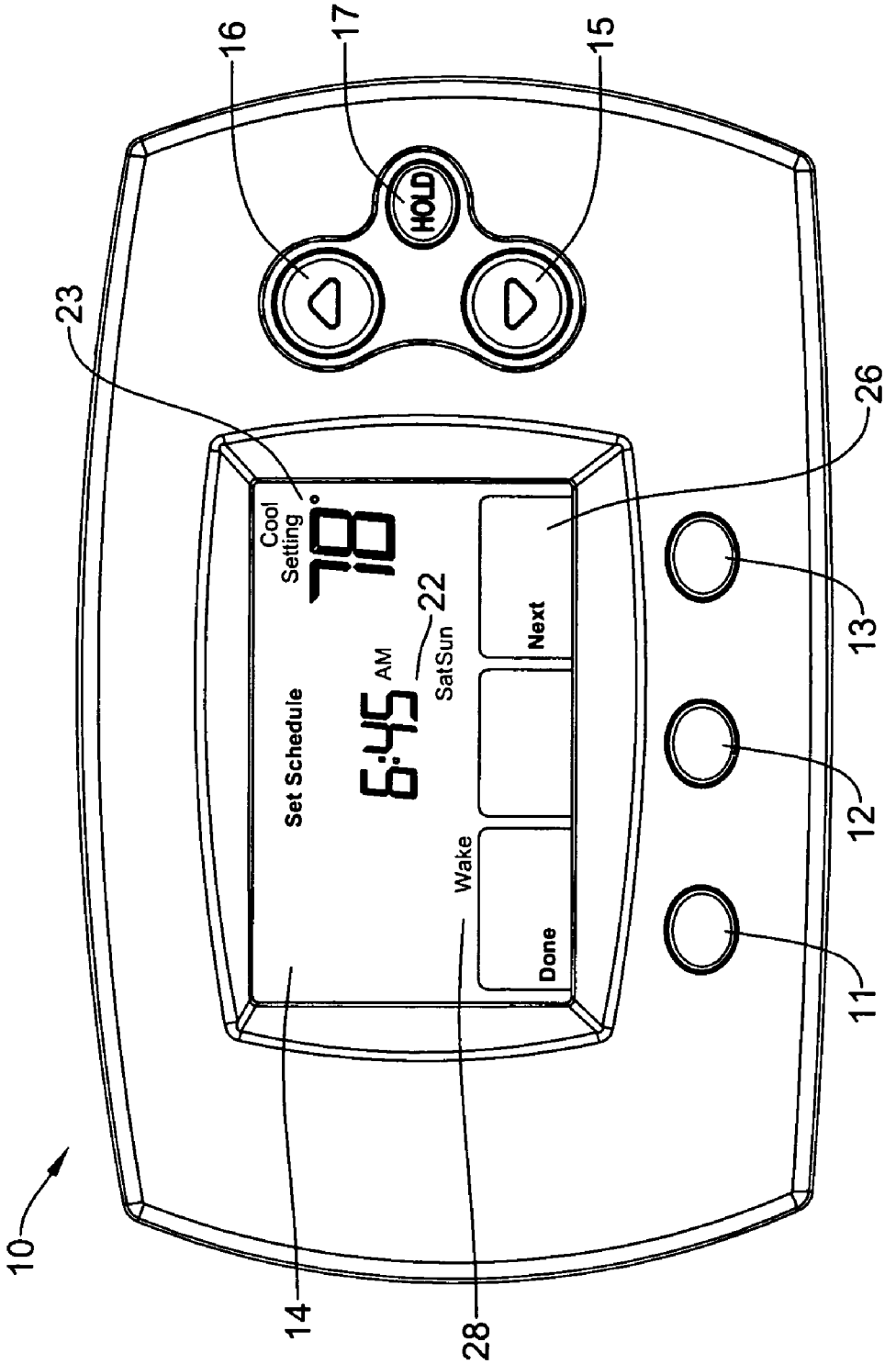
16
17
15
HOLD
23
26
Cool
Setting
78°
Set Schedule
6:45 AM
SatSun
22
Next
13
12
Wake
Done
11
10
14
28

Figure 21

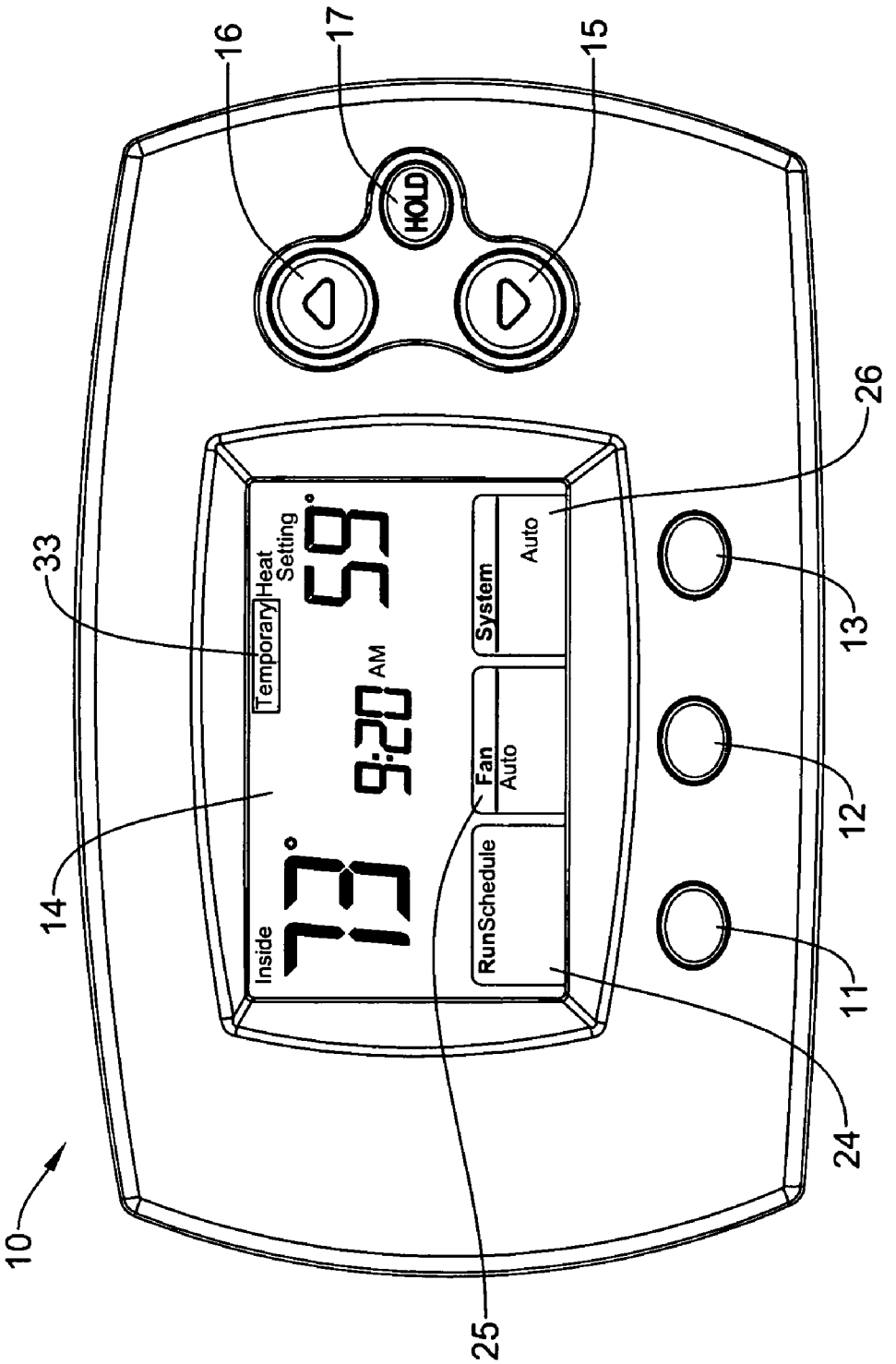
16
17
15
HOLD
26
33
Temporary
Heat
Setting
59°
System
Auto
13
Inside
73°
9:20 AM
Fan
Auto
12
14
RunSchedule
11
24
25
10

Figure 22

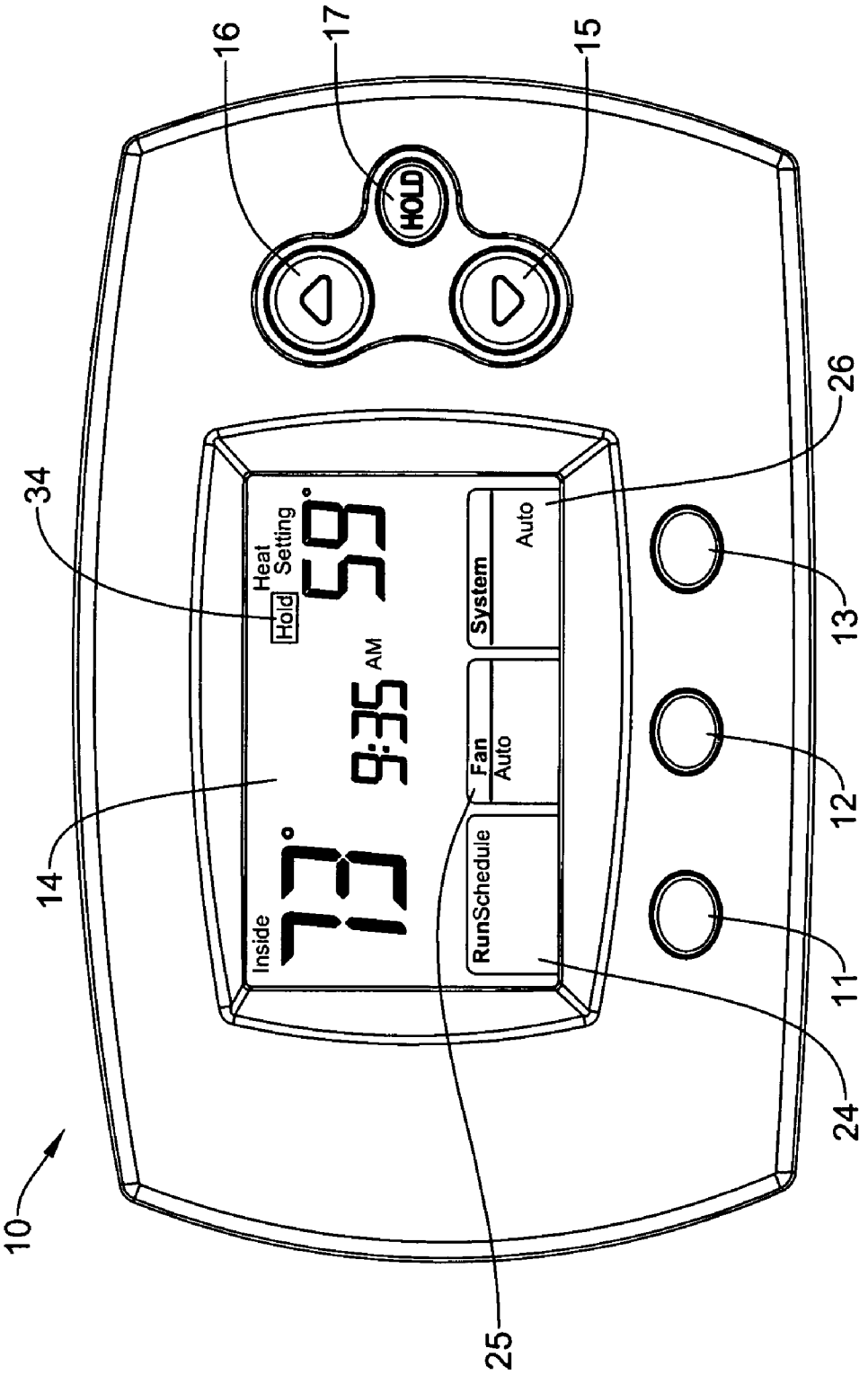
16
17
15
HOLD
26
34
Heat
Setting
59°
Hold
9:35 AM
System
Auto
13
Fan
Auto
12
Inside
73°
RunSchedule
11
14
24
25
10

Figure 23

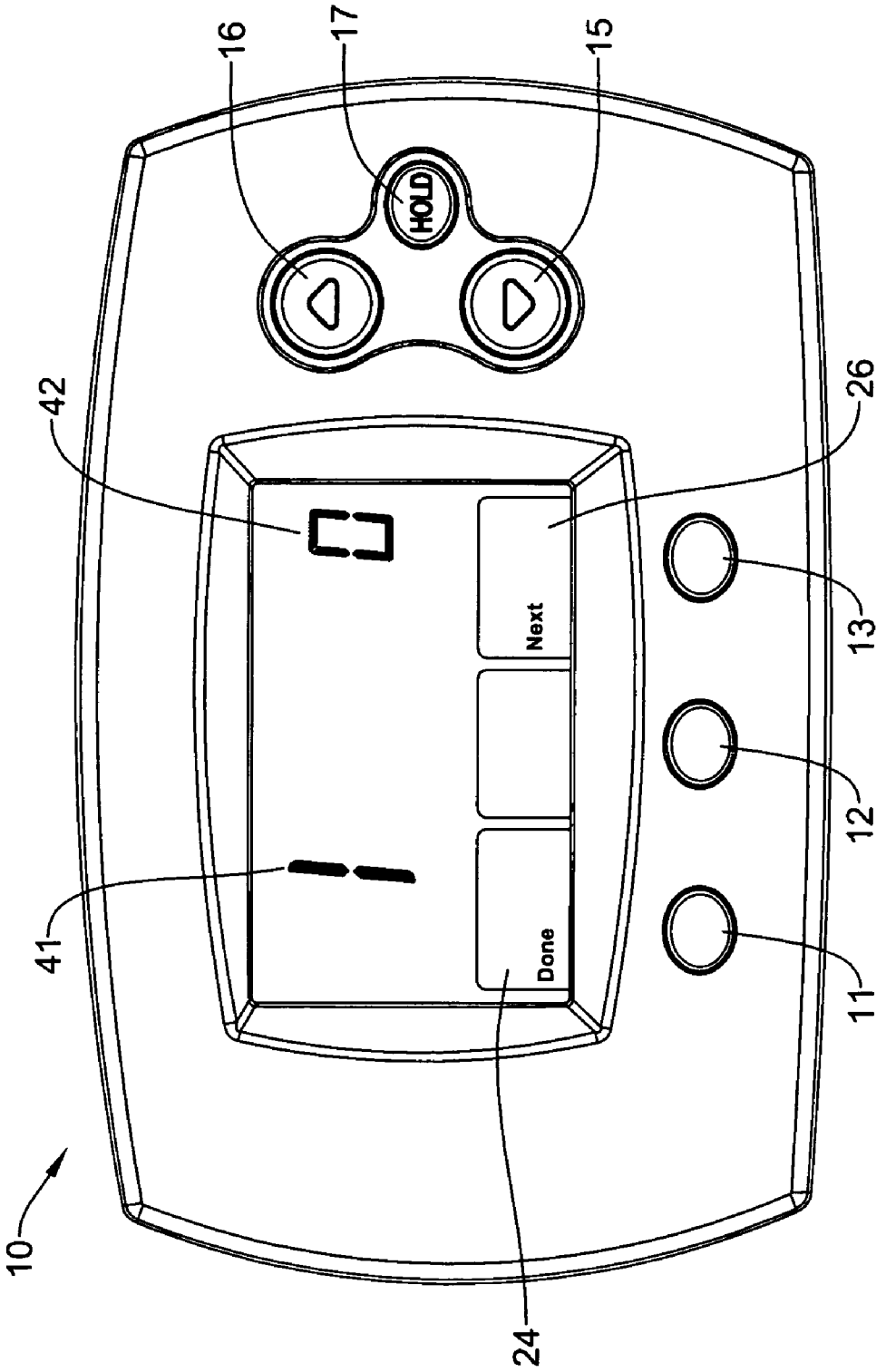

Figure 24

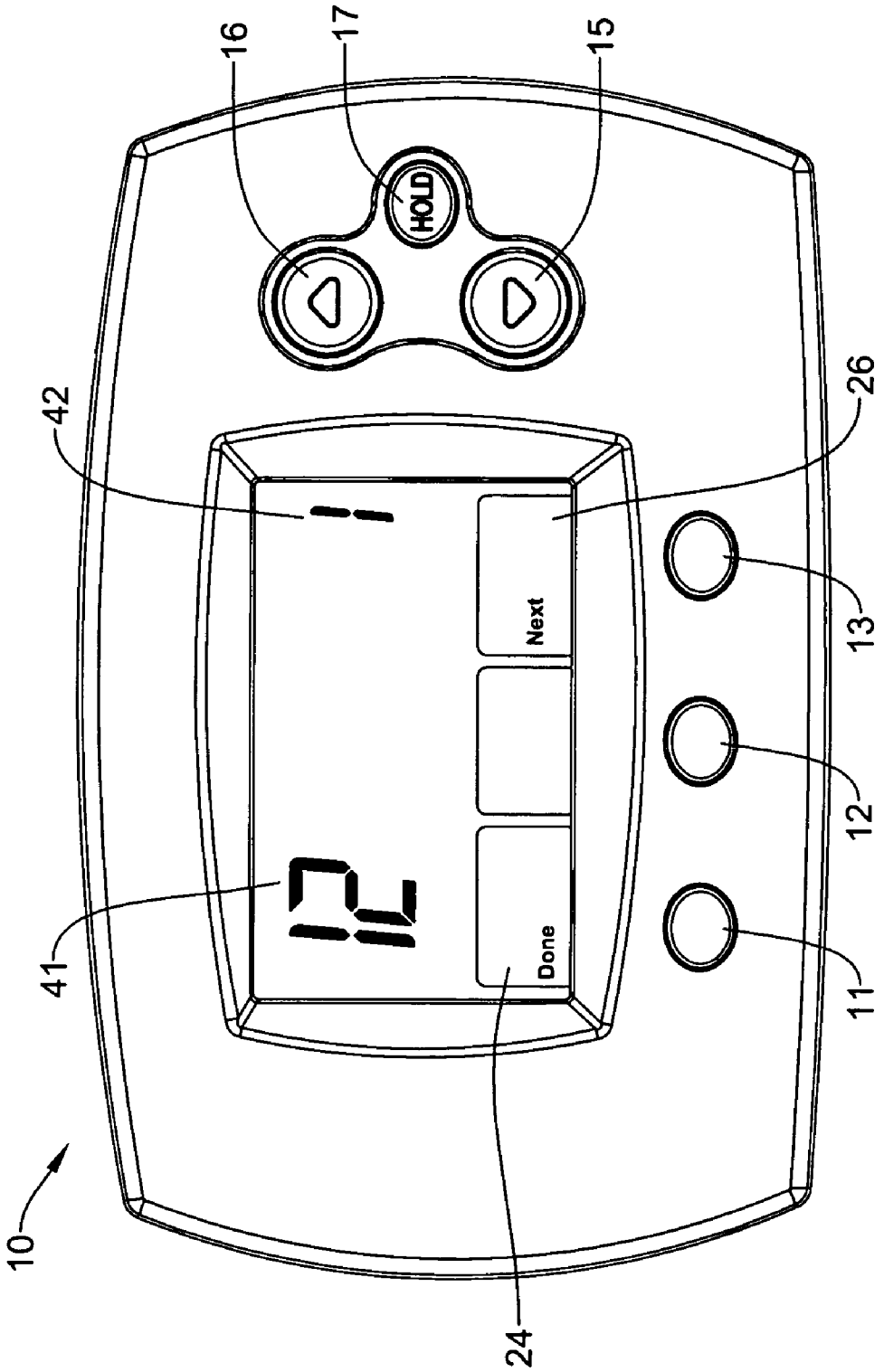

Figure 25

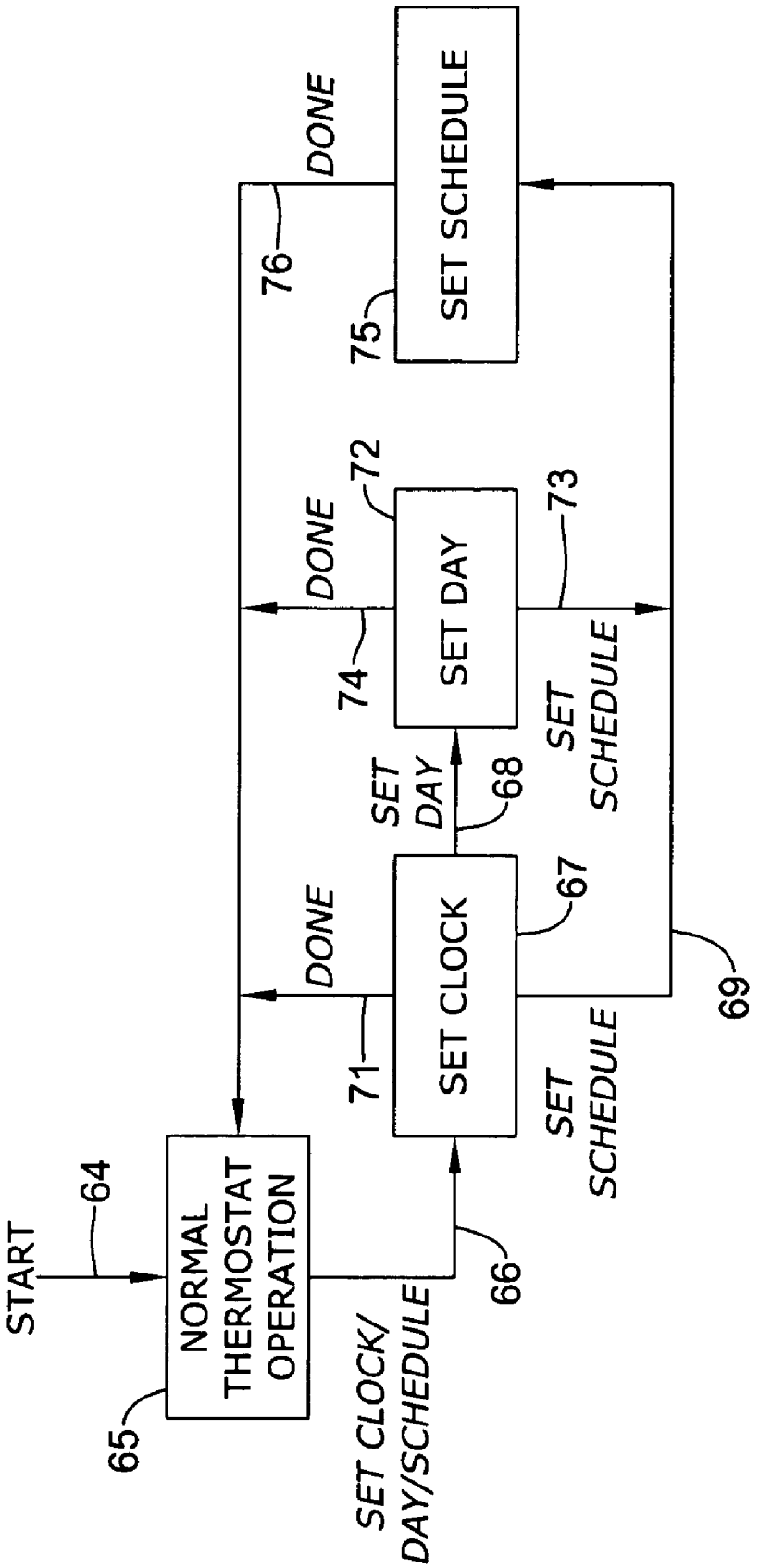
START
64
NORMAL THERMOSTAT OPERATION
65
SET CLOCK/ DAY/SCHEDULE
66
SET CLOCK
67
SET DAY
68
SET SCHEDULE
69
SET SCHEDULE
SET SCHEDULE
DONE
71
DONE
74
DONE
76
72
73
75

Figure 26

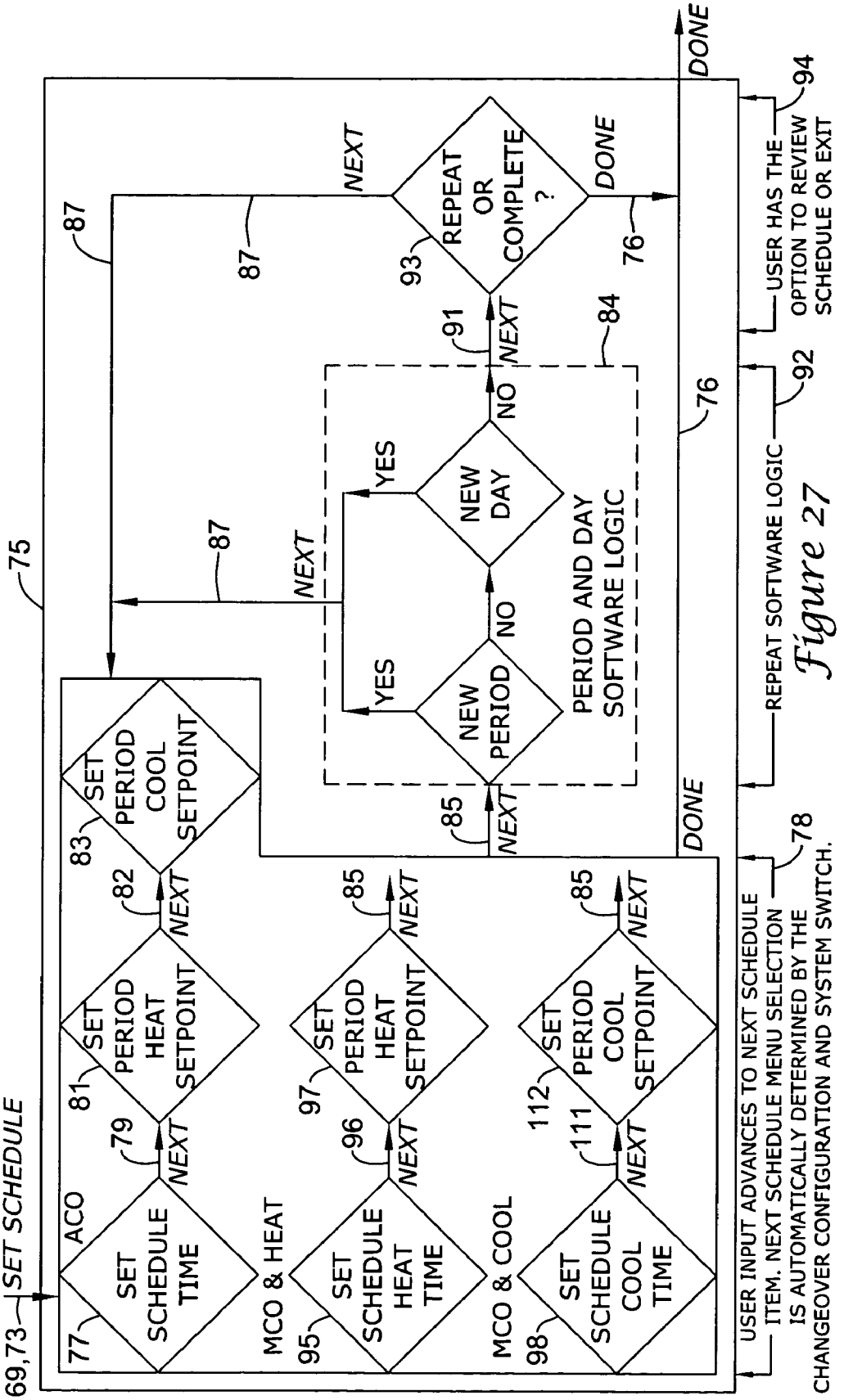
69,73
SET SCHEDULE
75
ACO
SET SCHEDULE TIME
77
79
NEXT
SET PERIOD HEAT SETPOINT
81
82
NEXT
SET PERIOD COOL SETPOINT
83
85
NEXT
MCO & HEAT
SET SCHEDULE HEAT TIME
95
96
NEXT
SET PERIOD HEAT SETPOINT
97
85
NEXT
MCO & COOL
SET SCHEDULE COOL TIME
98
111
NEXT
SET PERIOD COOL SETPOINT
112
85
NEXT
87
87
87
NEXT
NEXT
PERIOD AND DAY SOFTWARE LOGIC
84
NEW PERIOD
YES
NO
NEW DAY
YES
NO
91
NEXT
REPEAT OR COMPLETE ?
93
DONE
76
DONE
DONE
76
USER INPUT ADVANCES TO NEXT SCHEDULE ITEM. NEXT SCHEDULE MENU SELECTION IS AUTOMATICALLY DETERMINED BY THE CHANGEOVER CONFIGURATION AND SYSTEM SWITCH.
78
REPEAT SOFTWARE LOGIC
92
USER HAS THE OPTION TO REVIEW SCHEDULE OR EXIT
94

Figure 27

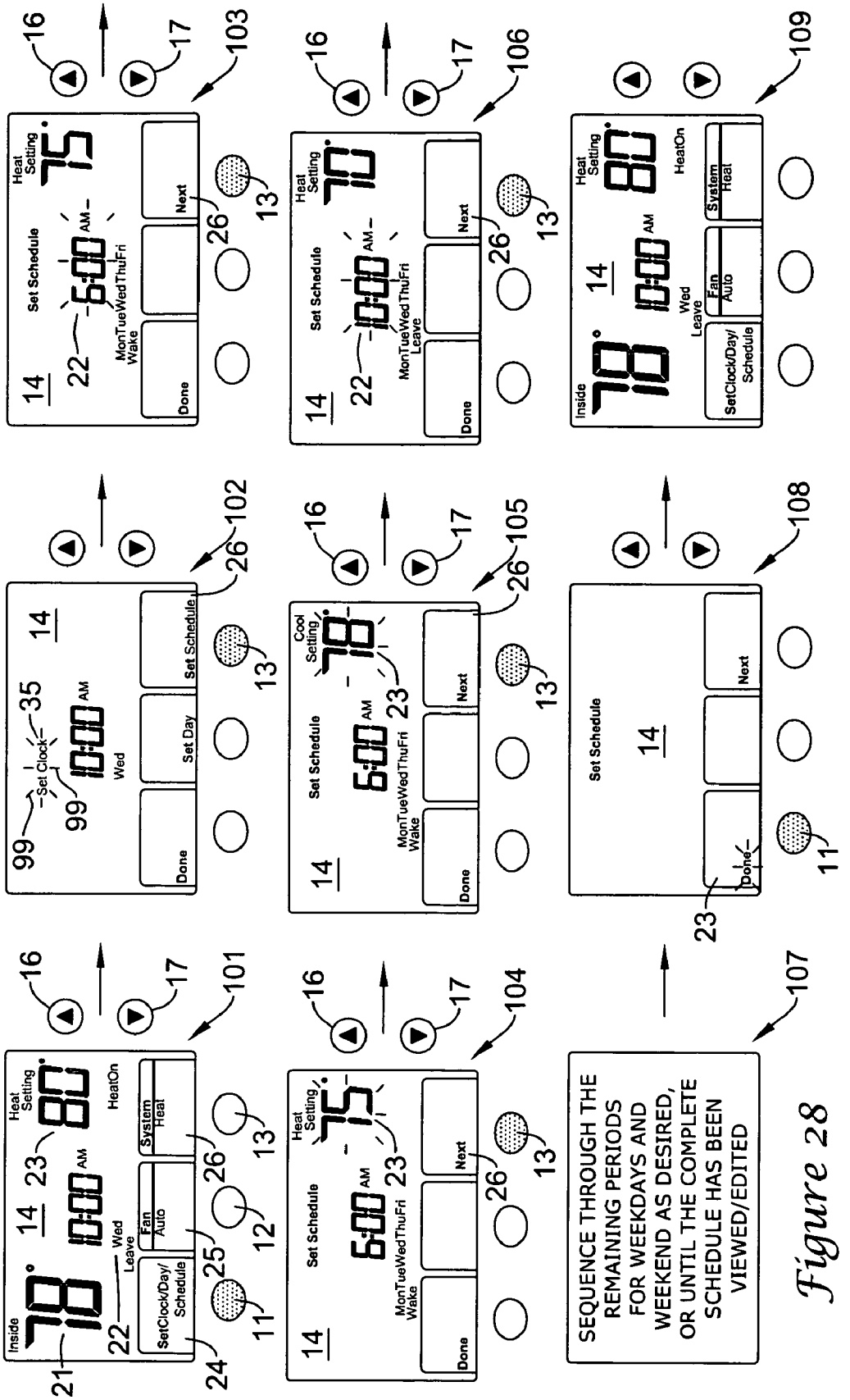
Inside
78°
14
10:00 AM
Wed
Leave
Heat Setting
80°
HeatOn
Fan
Auto
System
Heat
Set Clock/Day/
Schedule
Set Schedule
6:00 AM
Mon Tue Wed Thu Fri
Wake
Heat Setting
75°
Done
Next
Set Day
Set Clock
35
99
Cool Setting
78°
SEQUENCE THROUGH THE REMAINING PERIODS FOR WEEKDAYS AND WEEKEND AS DESIRED, OR UNTIL THE COMPLETE SCHEDULE HAS BEEN VIEWED/EDITED
21
22
23
24
25
26
11
12
13
16
17
101
102
103
104
105
106
107
108
109

Figure 28

AUTOMATIC THERMOSTAT SCHEDULE/PROGRAM SELECTOR SYSTEM

BACKGROUND

The present invention pertains to thermostats and particularly to programmable thermostats.

SUMMARY

The invention is a thermostat system that may have multiple schedules with each schedule having its own setpoints and times. The system may operate with one schedule at a time. There may be an option for combining the multiple schedules.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** shows a flow diagram of the changeover and auto changeover selection;

FIG. **2** shows a flow diagram of a setting schedule;

FIGS. **3-5** show example schedules;

FIG. **6** shows an example of the present thermostat;

FIG. **7** reveals a screen of the thermostat;

FIG. **8** shows a set clock mode;

FIG. **9** shows a set day mode;

FIGS. **10** and **11** show fan mode selections;

FIGS. **12-16** show various system selections;

FIGS. **17-20** show settings for several periods of a weekday;

FIG. **21** shows a weekend setting;

FIG. **22** shows a temporary override setting;

FIG. **23** shows a hold override setting;

FIG. **24** reveals a system configuration selection mode;

FIG. **25** reveals system options of manual changeover, auto changeover and auto changeover only;

FIG. **26** is a flow diagram for setting the clock, day and schedule of the thermostat system;

FIG. **27** is a flow diagram for the set a single schedule procedure; and

FIG. **28** is a menu storyboard diagram for clock and schedule settings.

DESCRIPTION

The present invention may be regarded as an automatic thermostat schedule/program selector. The selector may be at least a portion of thermostat control system used for controlling heating, ventilating and air conditioning (HVAC) equipment. Since some may regard the terms "schedule" and "program" as somewhat synonymous and interchangeable, the term "schedule" may be used in the present description. The thermostat described here is an illustrative example of the invention. The thermostat may provide a user with different schedules for heat and cool modes. An appropriate schedule may be automatically selected based on a system configuration (i.e., a manual changeover (MCO) or an automatic changeover (ACO)) and a system switch mode (i.e., heat or cool).

A default configuration may include the MCO and the heat mode. With this configuration, two or more schedules may be utilized. The latter may be seen by going into a "Set Schedule" menu and sequencing through the schedule. In this mode, the heat times and setpoints may be adjusted and/or viewed. To adjust and/or view the cool schedule, the user should first set the system to "Cool" (or "Off"), and then enter the "Set Schedule" menu. The schedule sequence may allow the user to adjust and/or view the cooling times and setpoints.

FIG. **1** shows a flow diagram of the two schedule manual changeover and auto changeover selection. First, an installer setup **43** may be entered, upon which a configuration decision **44** is to be made. The manual changeover **45** may be selected and lead to a load **46** heat schedule and load **47** cool schedule. Or, the auto changeover **48** may be selected and lead to a load **46** heat/cool schedule. FIG. **2** shows a flow diagram of the setting schedule **51** which may lead to a system switch decision. Selecting a "cool or off" **53** may lead to an edit **54** cool schedule. Selecting a "heat" **55** may lead to an edit **56** heat schedule.

FIGS. **3**, **4** and **5** reveal illustrative instances of a heat schedule **61**, a cool schedule **62**, and a heat/cool schedule **63**. There may be additional schedules. Each schedule may have its own multiplicity of periods. For an illustrative instance, the heat schedule **61** in FIG. **3** shows periods Wake, Leave, Return and Sleep, with their start times and heat temperature set points. Another schedule **62** in FIG. **4** shows those four periods with their start times and cool temperature set points. The start times for the cool schedule **62** may be different than those for the heat schedule **61**. Schedules **61** and **62** are for the manual changeover **45**. As shown in FIG. **5**, the schedules **61** and **62** may be combined into schedule **63** for the auto changeover **48**. When schedules **61** and **62** are combined into the schedule **63**, the start times of the heat schedule **61** for the four listed periods may prevail over the start times of schedule **62**. The heat/cool schedule **63** may be used when the system **10** is configured for auto changeover. The heat schedule **61** may be used when system **10** is configured for manual changeover, or for heat only. The cool schedule **62** may be used when the system **10** is configured for manual changeover, or for cool only.

FIGS. **6** and **7** show a thermostat **10** and its screen **14** which may utilize the present invention. Thermostat **10** may have separately programmable weekday/weekend schedules, one-touch temperature control to override a program schedule at any time, and an easy to read display at day or night time, which displays both ambient temperature and a temperature setting. These items and other items may be programmed in thermostat **10** with the thermostat disconnected from a heating and/or cooling system that the thermostat may be intended to control. Disconnecting the thermostat **10** from the heating and cooling system may involve merely unplugging the thermostat from, for example, a wall socket which is connected to the system. In other words, a user may program, modify or adjust items of the thermostat **10** while sitting in an armchair.

Thermostat **10** may have a screen **14** using LCD or other display technology, as in FIG. **7**. There may be three function buttons or softkeys **11**, **12** and **13**, which may be pressed to select a function labeled (e.g., menu or area) in the display **14** just above each button, respectively. The functions shown above each button may change depending on the task. An up (increase) button **16** and a down (decrease) button **15** (sometimes with appropriate arrow indications on the buttons) may be situated near the of display screen **14** on a face of the thermostat **10**. These buttons **15** and **16** may be used to adjust time and temperature setpoints. Proximate to buttons **15** and **16** may be a hold button **17** for overriding programmed temperature control.

FIG. **7** shows various components of the display screen **14**. Item **21** indicates the present inside temperature, item **22** shows the current time and day, item **23** shows a temperature setting or setpoint, and item **24** shows a function selection proximate to button **11**. Item **25** shows the fan settings proxi-

mate to button **12**, and item **26** shows a system setting function selection area proximate to button **13**. Also, on display **14** is a low battery warning ("Replace Battery") indicator **27**, a current program period indicator **28**, a system status indicator **29**, an auxiliary heat indicator **31**, and an "In Recovery" indicator **32**.

To set the time and day for thermostat **10**, the button **11** situated below area **21** which says "Set Clock/Day/Schedule" may be pressed. Then a "Set Clock" logo **35** may flash on and off near the center of screen **14** and next to the time and day display **22**, as shown in FIG. **8**. One may press button **15** or **16** to set the clock time. After the clock is set or is determined to already show the time as desired, then the button **12** under area **25** that says "Set Day", may be pressed which will result in a "Set Day" logo **36** that flashes on and off, as shown in FIG. **9**. The button **15** or **16** may be pressed for selecting the day of the week. Then one may press button **11** under area **24**, which says "Done", to save and exit the time and day option. There may additionally be a date indicator (not shown) which could be set.

The fan setting may be selected. Button **12** under the "Fan" setting area **25** may be pressed to select "Auto" or "On" for fan operation, as shown in FIGS. **10** and **11**. In the "Auto" mode, the fan may run only when the heating or cooling system is on. If set to "On", the fan may run continuously. The "On" setting may be used for improved air circulation, or for more efficient air cleaning. Area **25** in some versions of thermostat **10** may also have various fan or air mover speed settings.

A system setting may be selected menu **26**. The button **13** may be pressed to select "Heat" and get the heating system, as shown in FIG. **12**. With this selection, the thermostat **10** may control just the heating system. Button **13** may be pressed to select "Cool" and get the heating system, as shown in FIG. **13**. With this selection, the thermostat **10** may control just the cooling system. Button **13** may be pressed to select "Off." Here, both heating and cooling systems may be off. In some cases, one may get selections "Auto" or "Em Heat", as shown in FIGS. **14** and **15**, respectively. These system settings might not appear on the thermostat **10** as their appearance could depend on how the thermostat is installed. With the selection "Auto", the thermostat may automatically select the heating or cooling system depending on the indoor temperature **21** and the single schedule setpoint setting. The "Em Heat" selection may be for only heat pumps with auxiliary heat. Here, the thermostat **10** may control emergency and auxiliary heat, and lock out the compressor. There may be additional system settings or selections in menu **26**. FIG. **16** of thermostat **10** shows "Off" selected in system menu **26**. Here, screen **14** might reveal only the inside temperature **21**, the time **22**, and the three menus at the bottom of the screen.

The thermostat **10** may be programmed for maximum energy savings. Four time periods **28** for each day may be programmed, with different settings for weekdays and weekends. There may be more or less than four periods. The four periods may constitute an illustrative example. The four periods **28** may be referred to as "Wake", "Leave", "Return" and "Sleep." The following example settings may be done for weekdays in the "Heat" System. For example, for the "Wake" period **28**, the time **22** may be set to the time that an occupant awakens and the temperature **23** for this period **28** may be set until the occupant leaves for the day. FIG. **17** indicates that the temperature **23** may be set for 75 degrees for 6:30 A.M. To move along in the set schedule procedure, the user may press softkey or button **13** under area **26** which indicates "Next". The next period **28** may be the "Leave" period, where the occupant may set the time **22** for leaving the house and the temperature **23** that the occupant wants while away from the house. This setting may be an energy saving level. FIG. **18** indicates that the temperature **23** may be set for 59 degrees for 8:30 A.M. The user may press softkey **12** under area **25** which indicates "Cancel Period" to eliminate unwanted time periods except "Wake". The next period **28** may be the "Return" period, where the occupant returns to the house. This is where the occupant sets the thermostat **10** to the time **22** for when the occupant returns to the house, and sets the temperature **23** that the occupant wants during the evening until bedtime. FIG. **19** shows that the temperature **23** may be set at 71 degrees for the return period **28** starting at 7:00 P.M. The "Sleep" period **28** begins when the occupant goes to bed and wants a temperature **23** set for overnight. The temperature **23** setting may be an energy-saving level. FIG. **20** indicates that the temperature **23** may be set for 65 degrees beginning at 10:30 P.M.

Programmed settings may also be done for weekends. Besides the Heat settings, Cool settings **23** may also be done for each of the four periods **28**, as was done with Heat settings **23**. FIG. **21** is an example of a weekend Cool setting **23** of 78 degrees for a "Wake" period **28** at a time **22** of 6:45 A.M. In some versions of thermostat **10**, virtually any number of and/or different periods and temperature settings may be uniquely programmed for individual days of the week, or for one or more, if not all, dates of a week, month or year.

The thermostat **10** may be pre-set to use EnergyStar® program settings for keeping heating and cooling expenses down. The "Wake" period may begin at 6:00 A.M. for weekdays and weekends. The "Heat" may be set at 70 degrees and the "Cool" may be set at 75 degrees. The "Leave" period may begin at 8:00 A.M. for weekdays and weekends. The "Heat" may be set at 62 degrees and the "Cool" at 75 degrees. The "Return" period may begin at 6:00 P.M. for weekdays and weekends. The "Heat" may be set at 70 degrees and the "Cool" at 75 degrees. The "Sleep" period may begin at 10:00 P.M. for weekdays and weekends. The "Heat" may be set at 62 degrees and the "Cool" at 78 degrees. The above-mentioned settings may apply to both weekdays and the weekend. However, one or more settings and/or periods may be canceled for the weekend. The program schedules may be adjusted in a variety of ways as indicated in the present description.

For one reason or another, the user may wish to do a program schedule override in a temporary fashion. To enter the override status, the user may press button **15** or **16** and hold it down for a couple seconds. Then a label **33** showing "Temporary" on the display screen may appear, as shown in FIG. **22**. Then the user may adjust the temperature setting with the button **15** or **16** for a desired temperature. This temperature setting may temporarily override the temperature setting for the current time period, whether it be the "Wake," "Leave," "Return" or "Sleep" period. This new temperature may be maintained only until the next programmed time begins. For instance, if the user wants to turn the heat up during the "Wake" period, it will automatically be lowered upon the start of the "Leave" period to the previously set temperature of the latter period. The temporary setting may be cancelled at any time by pressing button **11** with "Run Schedule" showing in area **24**, as shown in FIG. **22**, and then the "Set Clock/Day/Schedule" label may return to area **24**. When setting the thermostat **10**, the occupant should assure that the thermostat selection is to the system (e.g., "Heat," "Cool" or "Auto") which is to be controlled.

The occupant may want to program a schedule override that is permanent. To do so, the occupant may press the "HOLD" button **17** and permanently adjust the temperature. This temperature adjustment may override the temperature

settings for all time periods. To do this permanent override, the occupant would first assure that the thermostat **10** is set to the desired system (i.e., Heat, Cool, or Auto) to be controlled. The "HOLD" button **17** may turn off the program schedule and allow the occupant to adjust the thermostat manually, as desired. Whatever temperature is set will be maintained 24 hours a day, until it is manually changed. A "Hold" label **34**, shown in FIG. **23**, may be present on display **14** when the permanent program schedule override is in effect. To cancel the "Hold," one may go to button **11** under area **24** which says "Run Schedule" and press the button to resume the programmed schedule.

Instead of being in the "Heat" or "Cool" system, thermostat **10** may go from the MCO to the ACO (i.e., the Auto Changeover). The auto changeover may be used in climates where both air conditioning and heating are used on the same day. The system may be set to "Auto" by pressing the button **13** until "Auto" shows up in area **26** as shown in FIG. **22**. When the system is set to "Auto," the thermostat **10** may automatically select heating or cooling, depending on the indoor temperature. Heating system and cooling system settings may be at a minimum at least three degrees apart. The thermostat may automatically adjust the settings to maintain the three degree separation (i.e., deadband). However, this separation could be adjusted to another value.

Thermostat **10** may have a built-in compressor protection, which may help prevent damage to the compressor in the associated air conditioning or heat pump system. Damage may occur if the compressor is restarted too soon after shutdown. The compressor may be forced to wait several minutes before restarting. During this wait time, the display **14** may flash a message label **29** "Cool On" or "Heat On" if a heat pump is associated with the system as shown in FIG. **7**. When a safe wait time has elapsed, the message label **29** flashing may stop and the compressor may turn on. The location of label **29** is shown in FIG. **7**.

The thermostat **10** may have an Adaptive Intelligent Recovery™ (AIR) aspect that may permit the thermostat to "learn" how long the furnace or air conditioner takes to reach the temperature setting. For instance, the user may set the program schedule to the time that the house is to reach the desired temperature. Then the thermostat **10** may turn on the heating or cooling system at an appropriate time before the scheduled time to reach the set temperature at the scheduled time. For example, the user may set the "Wake" time to 6:00 A.M., so that the temperature is at 70 degrees by 6:00 A.M. When the Adaptive Intelligent Recovery™ is in effect, the display **14** of thermostat **10** will display an "In Recovery" label **32**, as shown in FIG. **7**.

A system configuration may be selected for the thermostat **10**. Buttons **12** and **16** may be pressed together for about 4 seconds to enter the configuration mode. Numeral placeholder **41** may show a number that represents a set up category for a system that the thermostat **10** may control. Numeral placeholder **42** may show a number that represents a category option. For instance, when entering the configuration mode, a number "1" may appear in the placeholder **41**, which refers to a system type, as shown in FIG. **24**. A number "0" may appear in the placeholder **42**, which refers to a standard heating cooling setup. The category option "0" may be a default value for the set up category "1". Set up category "1" may have other category options including "1" (heat pump), "2" (heat only), "3" (heat only with fan), "4" (cool only), "5" (two heat, one cool, heat pump), "6" (two heat, two cool, conventional), "7" (two heat, one cool, conventional), and "8" (one heat, two cool, conventional). If button **13** under area **26** with "Next" is pressed one or more times, a set up category number "12" may appear in placeholder **41**, as shown in FIG. **25**. Number "12" may represent an "Auto Changeover" category. The category options indicated in placeholder may include "0" (manual changeover), "1" (auto changeover), and "3" (auto changeover only). Numerous other set up categories and category options designated by other numbers in placeholders **41** and **42**, respectively, may be designed into thermostat **10** as desired. The configuration mode may be exited by pressing button **11** under area **24** indicating "Done".

FIG. **26** shows a flow diagram for setting a clock, day and schedule of the programmable thermostat. The legend for this Figure has boxes representing main menus and the italic text representing softkey options. A start **64** may result in a normal thermostat operation menu **65**. Pressing a softkey option proximate to a set clock/day/schedule **66** indication may lead to a set clock menu **67**. After the clock is set or checked, an option to set **68** the date, set **69** the schedule, or select done **71**, may be selected with the softkey. The set day menu **72** may be selected via option **68**. Upon setting or checking the day, then an option to set **73** the schedule or select done may be effected with the softkey. The set schedule menu **75** may be selected via option **73**. Upon setting the schedule with menu **75**, then the done softkey option **76** may be selected.

The set schedule menu **75** is shown in FIG. **27**. Softkey options are shown in italic text and menus in diamonds. A softkey selection **69**, **73** may provide a set schedule time item **77** for the first period, depending on changeover configuration and system switch setting. Range **78** may cover the different schedule setting/viewing options. The different schedule options may be for auto changeover, manual changeover with system switch in heat, and manual changeover with system switch in cool (or off). A schedule menu selection may automatically be determined by the changeover configuration and system switch.

The user may select the softkey next option to advance to the next menu item or select the softkey done option to exit the schedule menu. For the Auto changeover schedule option, upon completion of item **77**, setting the period time, a user may select the done softkey option **76** or a next softkey option **79**. The latter may be selected to continue the set schedule procedure. The next item **81** may be to set the period heat setpoint. Option **76** may be selected to be done or option **82** may be selected to go to the next item **83** to set the period cool setpoint. Option **76** may be selected to be done or the next item **85** may be selected to advance to item **84**, period and day repeat software logic. For the manual changeover with system switch in heat schedule option, upon completion of setting the heat period time, item **95**, a user may select the done softkey option **76** or a next softkey option **96**. The next item **97** may be to set the period heat setpoint. Option **76** may be selected to be done or the next item **85** may be selected to advance to item **84**, period and day repeat software logic. For the manual changeover with system switch in cool (or off) schedule option, upon completion of setting the cool period time, item **98**, a user may select the done softkey option **76** or a next softkey option **111**. The next item **112** may be to set the period cool setpoint. Option **76** may be selected to be done or the next item **85** may be selected to advance to item **84**, the period and day repeat software logic. Upon completion of range **78**, the done option **76** may be selected to exit the set schedule menu or a next option **85** may be selected which leads to the automatic new period and day software logic item **84**. The period and day software logic **84** may automatically advance the user to repeat the range **78** via path **87** with a new period and/or day, or to advance to range **94**. The period and day software logic **84** may repeat range **78** for each period and day

of the schedule. Upon completion of the period and day software logic **84**, hence having completed all periods and days, the next item **91** (same user action as item **85**) may advance the user to item **93**, the repeat or complete user option. Range **94** may indicate that the user has the option to review the schedule or exit. To review or repeat the schedule through range **78** and range **92**, option **87** may be selected. If complete, then the done option **76** may be selected to return to the normal thermostat operation **65** of FIG. **26**.

FIG. **28** is a clock and auto changeover schedule storyboard of illustrations **101-109**. System **10** is easily programmable with sequential programming having a minimally small number of steps. A user may advance a menu by pressing a softkey **13** or modify a setting by pressing up/down keys **16** and **17**. Illustration **101** shows a home screen **14** at normal operation. It shows the inside temperature **21**, day and time **22**, temperature setting **23**, menus **24**, **25** and **26** corresponding to softkeys **11**, **12** and **13**, respectively. Pressing softkey **11** under menu **24** showing "Set Clock/Day/Schedule" in illustration **101** may lead to screen **14** in illustration **102**, with a flashing "Set Clock" label segments **35**, as depicted with short marks **99** radially extending out from the encircled label **35**. These marks may indicate flashing of the segments which they are associated with also in other illustrations. Here the clock or time indication **22** may be advanced with an up (arrow) button or key **16** or backed up with a down (arrow) button or key **17**.

After the clock is set, button **13** under menu **26** showing "Set Schedule" may be pressed to get illustration **103** of the screen **14**. It shows flashing segments of clock **22** with a time for a start of the Wake period. Key **16** or **17** may be pressed to set the time. Softkey **13** under menu **26** that shows "Next" may be pressed to get a screen **14** as shown in illustration **104**. That screen **14** may show flashing segments for a heat temperature setpoint **23**. Temperature setpoint **23** may be adjusted or set by pressing key **16** or **17**. After the heat temperature setpoint **23** is adjusted, softkey **13** under menu **26** indicating "Next" may be pressed to get illustration **105** of a screen **14** that shows flashing segments for a cool temperature setpoint **23**. The cool temperature setpoint may be adjusted or set by pressing adjustment key **16** or **17**.

After the cool temperature setpoint is adjusted, softkey **13** under menu **26** indicating "Next" may be pressed to get illustration **106** which shows the screen **14** with flashing segments of clock **22** with a start time for the Leave period. The time may be set with keys **16** and **17**, as done for the Wake period. The temperature setpoints **23** may be similarly set. The user may sequence through the periods for weekdays and the weekend, as desired, until the complete schedule has been viewed or edited, as indicated in illustration **107**. There may be four periods, Wake, Leave, Return and Sleep, as noted at other places of this description. At any point of the set schedule procedure, the user may press a softkey **11** under menu **24**, which indicates "Done", and return to the home screen **14** normal operation. However, if the user proceeds to complete the set schedule procedure, a screen **14** as shown in illustration **108** may appear. The screen of illustration **108** may show flashing segments of "Done" in menu **24** to indicate completion of the procedure. The user may then press softkey **11** to get the screen **14** of illustration **109** showing the home screen normal operation.

When going through the period and temperature settings, as in the storyboard illustrations **101-109**, one may be permitted to make both heat and cool settings if the system **10** is set in menu **26** to "Heat", "Cool", "Auto" or "Off" for "auto changeover", or to "Auto" for "auto changeover only". "Auto" might be the only system selection available in menu **26** for "auto changeover only". One might be permitted to make only heat settings for a system selection of "Heat", only cool settings for a system selection of "Cool", and only cool settings for a system selection of "Off" in menu **26** when system **10** in manual changeover. However, thermostat system **10** may be designed and/or programmed, as desired, to consist of variants of the noted configurations, modes and settings, in this paragraph, such as editing schedules from any mode or system selection, and in other places of the present description.

A system may be designed similar to system **10** but without being programmable. However, such non-programmable thermostat system may also have a selectable "auto only" configuration that does not have a system selection of "Off". Both systems may benefit with the "auto only" aspect, in that a system cannot be switched off, for instance, accidentally by adults or by children playing with the system. This may prevent misery to a challenged person unable to switch on or control the system in exceptionally hot weather, or avoid damage to a water system of a house that is left unoccupied for a period of time in a cold climate. There are other mishaps which the "auto only" aspect of the thermostat system may avoid or prevent.

The programming, scheduling, settings, modes, configuration option selections, and the like, described herein may be performed by a user on a thermostat system **10** in an armchair.

In the present specification, some of the matter may be of a hypothetical or prophetic nature although stated in another manner or tense.

Although the invention has been described with respect to at least one illustrative example, many variations and modifications will become apparent to those skilled in the art upon reading the present specification. It is therefore the intention that the appended claims be interpreted as broadly as possible in view of the prior art to include all such variations and modifications.

What is claimed is:

1. A controller system comprising:
- a heat schedule;
- a cool schedule;
- an automatic changeover;
- an automatic only changeover; and
- a manual changeover; and
- wherein for a manual changeover either the heat or cool schedule is automatically selected from the heat and cool schedule group for the controller system based on whether the manual changeover is set to heat or cool, respectively,
- wherein when the automatic only changeover is selected, the controller system cannot be turned off.

2. The system of claim **1**, wherein:
- the heat schedule comprises a plurality of heat temperature setpoints;
- the cooling schedule comprises a plurality of cool temperature setpoints;
- each heat temperature setpoint has an associated heat time setpoint; and
- each cool temperature setpoint has an associated cool time setpoint.

3. The system of claim **1**, wherein the heat schedule and the cool schedule may be edited with the controller system disconnected from another system that the controller system is to control.

4. The system of claim **2**, wherein each time setpoint is a beginning of a time period and an end of previous period if preceded by the previous time period.

5. The system of claim 2, further comprising:

a heat/cool schedule; and

wherein the heat/cool schedule is a combining of the plurality of heat setpoints and the plurality of cool setpoints.

6. The system of claim 5, wherein the automatic changeover is a selection of the heat/cool schedule for the controller system in lieu of a heating schedule or a cooling schedule.

7. The system of claim 5, wherein the heat/cool schedule may be edited with the controller system disconnected from another system that is to be controlled by the controller system.

8. A method for programming a controller system comprising:

loading a heat schedule into the controller system;

loading a cool schedule into the controller system;

selecting one of the heat and cool schedules for the controller system to implement; and

editing the selected heat or cool schedule, wherein a user is prevented from editing a non-selected heat or cool schedule.

9. The method of claim 8, wherein selecting one of the heat and cool schedules is a manual changeover configuration.

10. The method of claim 9, further comprising:

combining the heat schedule and the cool schedule in to a heat/cool schedule; wherein selecting the heat/cool schedule is an auto changeover configuration, wherein when the auto changeover configuration is selected, a user is prevented from turning off the controller system.

11. The method of claim 10, further comprising:

editing the heat schedule and/or cool schedule; and

wherein the editing of the heat schedule and/or the cool schedule may be performed on the controller system with the controller system disconnected from another system to be controlled by the controller system.

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